Context-Aware Embeddings for Automatic Art Analysis

Noa Garcia

Benjamin Renoust

Yuta Nakashima

大阪大学データビリティフロンティア機構
Osaka University Institute for Datability Science

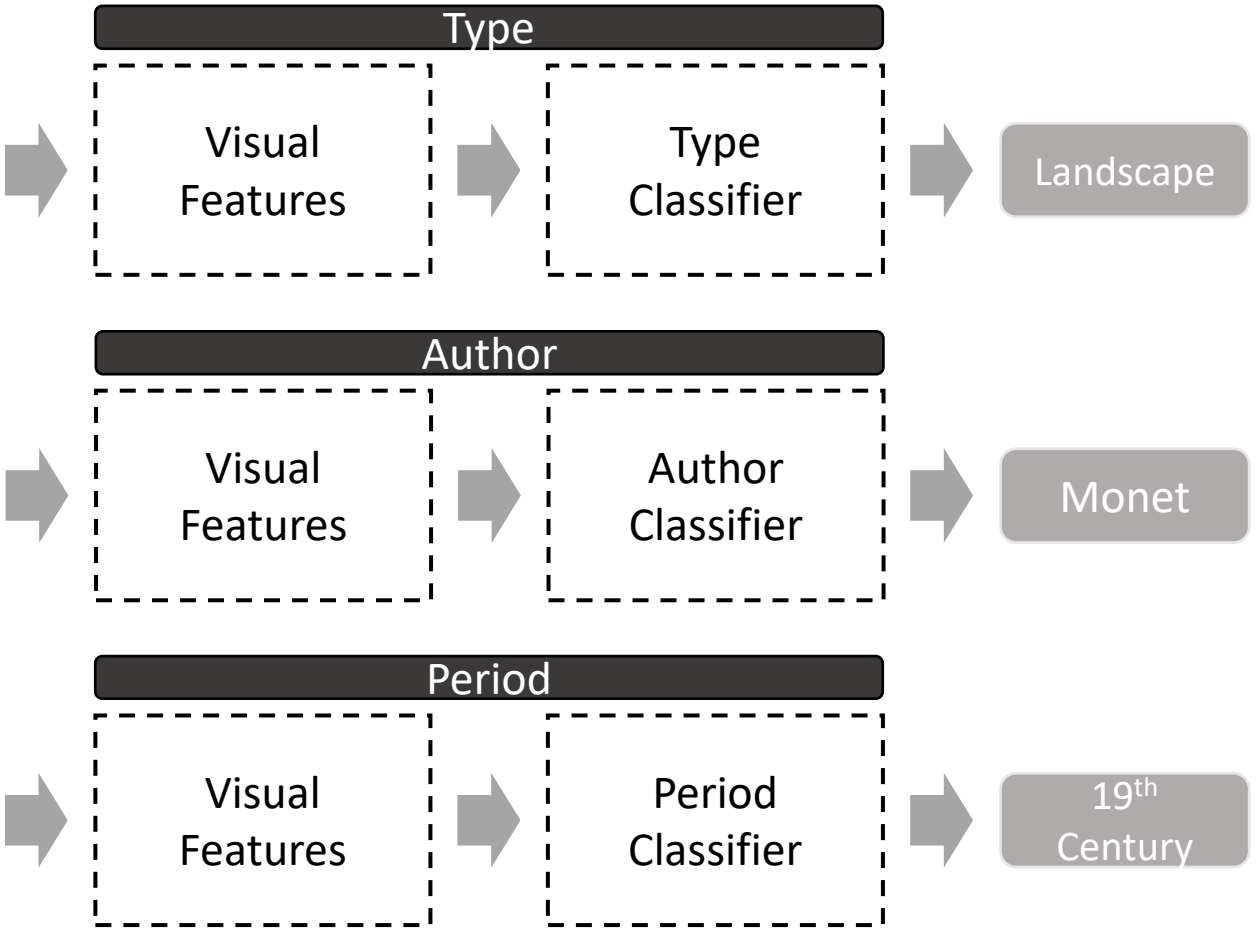
Automatic Art Analysis

Impression, Sunrise (1872) – Claude Monet

The study of artistic attributes in paintings by means of computer vision techniques.

Automatic Art Analysis

Impression, Sunrise (1872) – Claude Monet



Automatic Art Analysis

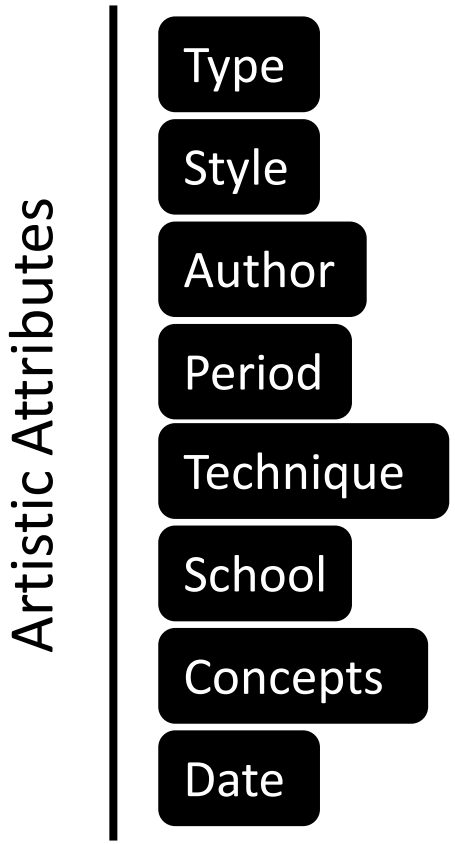
Visual Features Extraction

Artistic Attribute Classifier

Each attribute is studied independently:

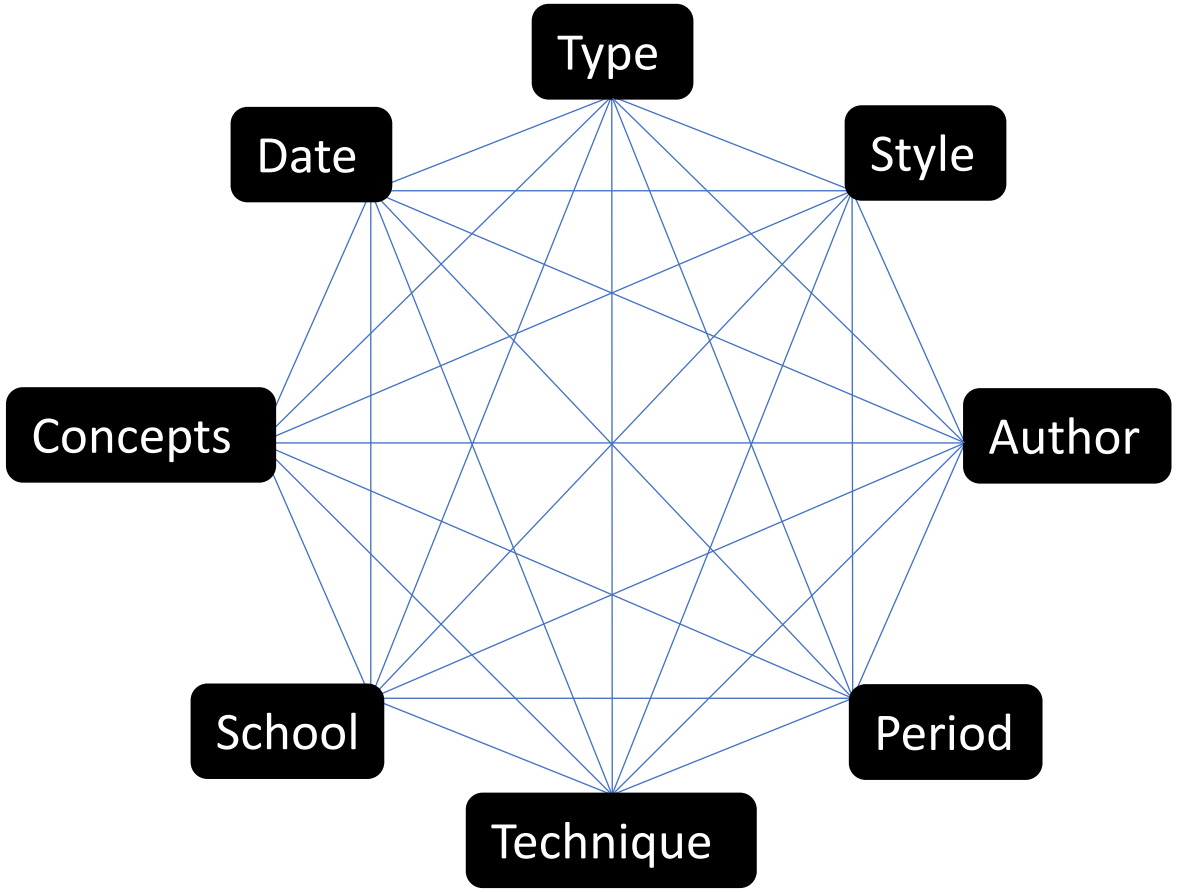
- Fine-tuned model for each attribute (Strezoski and Worring, 2018)
- Deep correlation features for style (Chu and Wu, 2018)
- Two branch network for style and content (Mao et al. 2017)

Automatic Art Analysis



Automatic Art Analysis

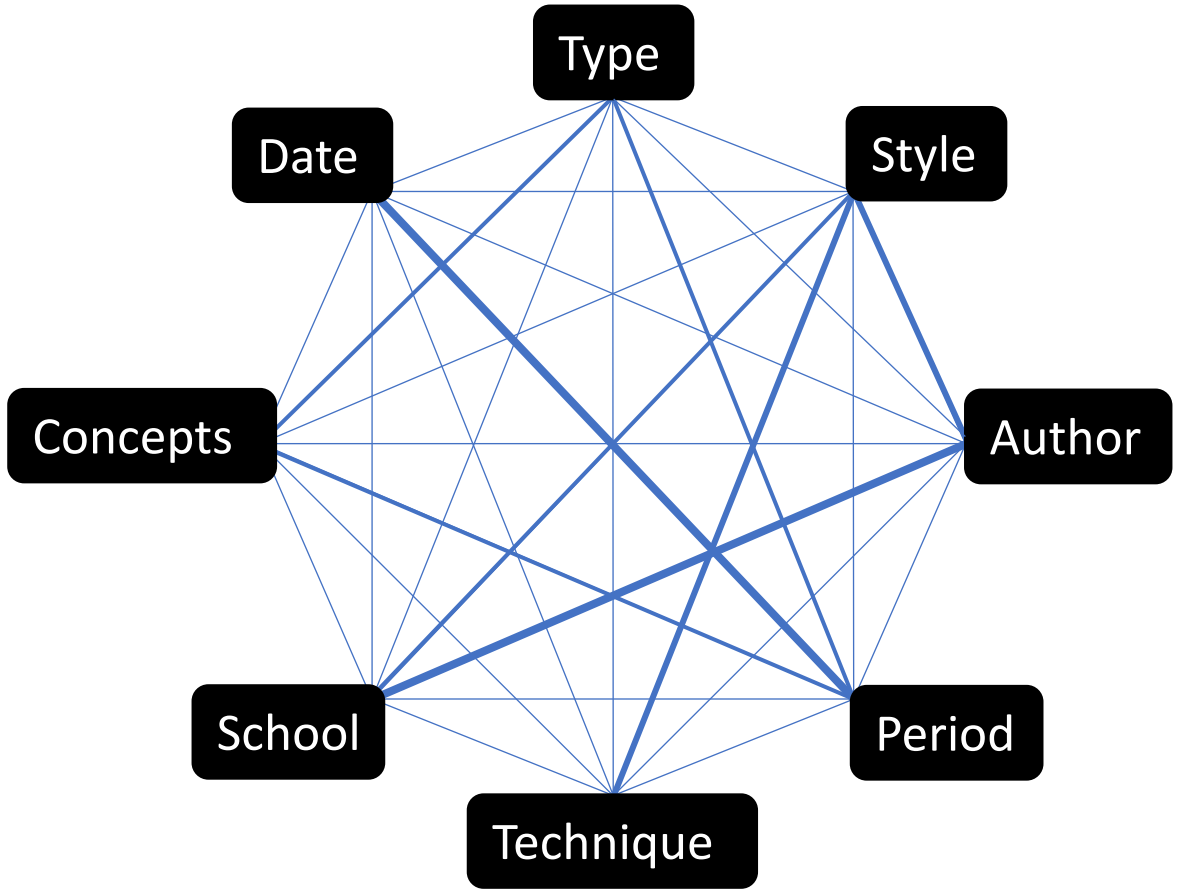
Artistic Attributes



Automatic Art Analysis

Learning the connections between artistic attributes may help in the analysis of art.

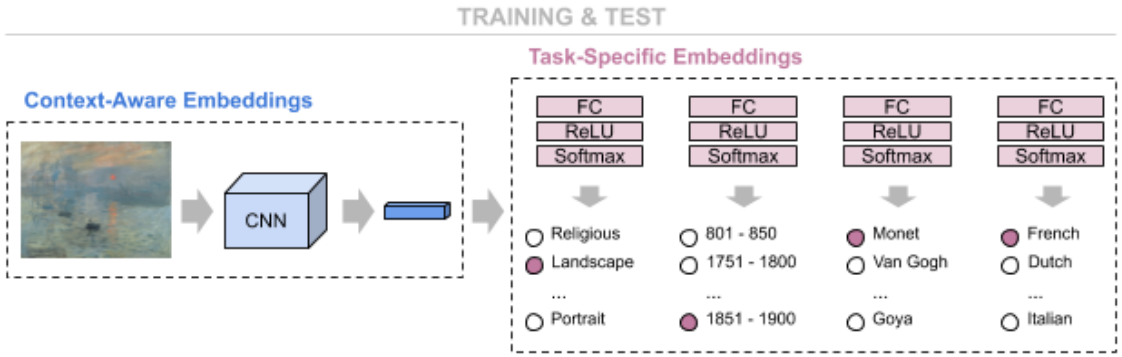
We propose to capture these relationships with Context-Aware Embeddings.



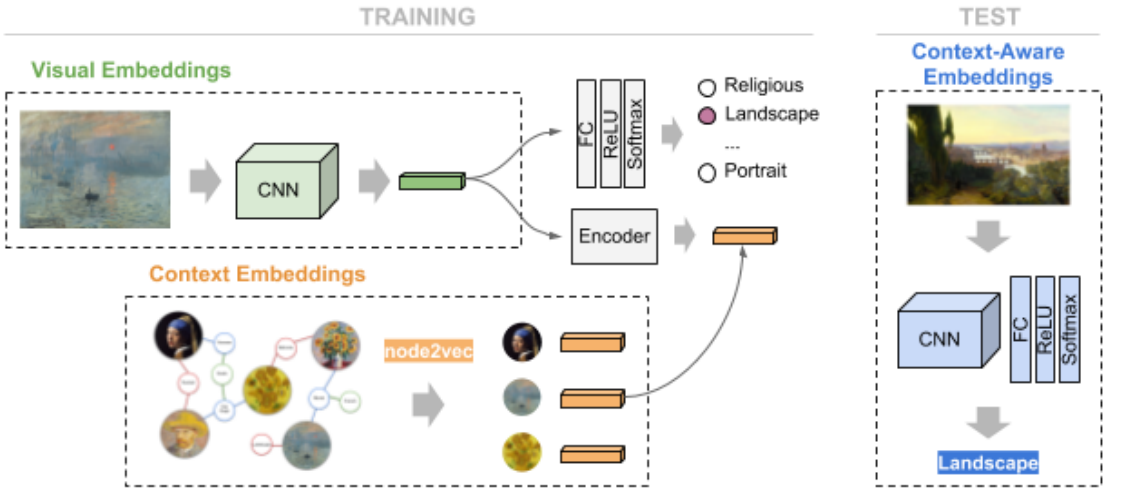
Context-Aware Embeddings

- We study two different models:

Multi-Task Learning Model

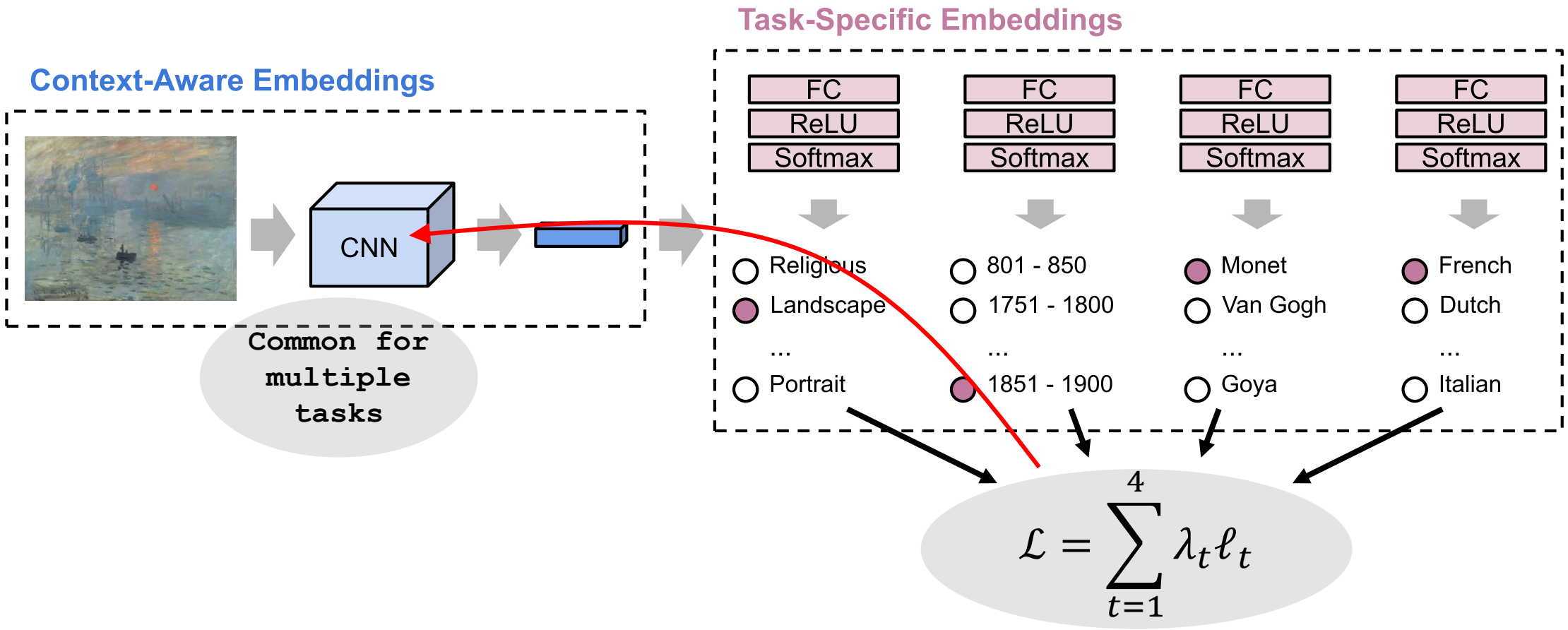


Knowledge Graph Model



Multi-Task Learning Model

Context is obtained from common visual elements between attributes.



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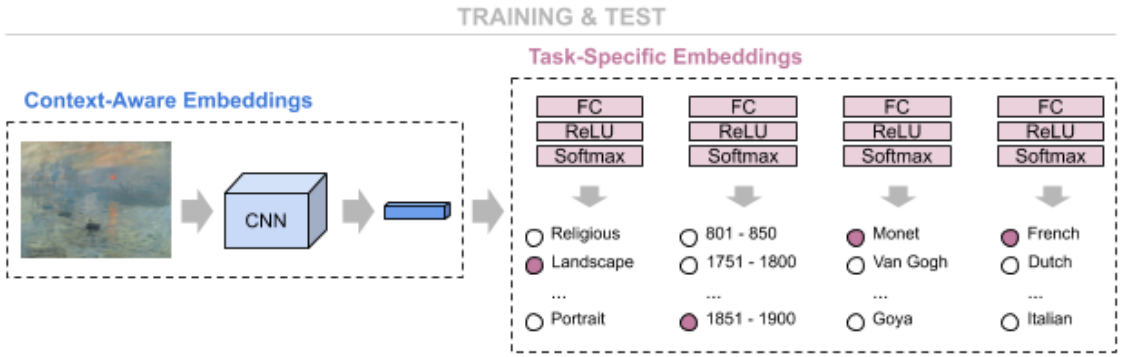
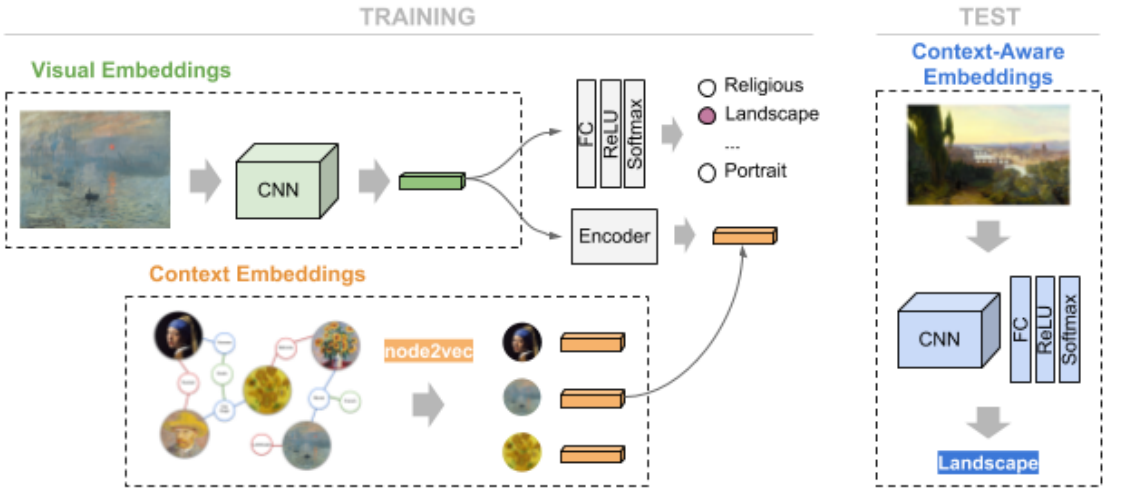


Knowledge Graph Model



Knowledge Graph Model

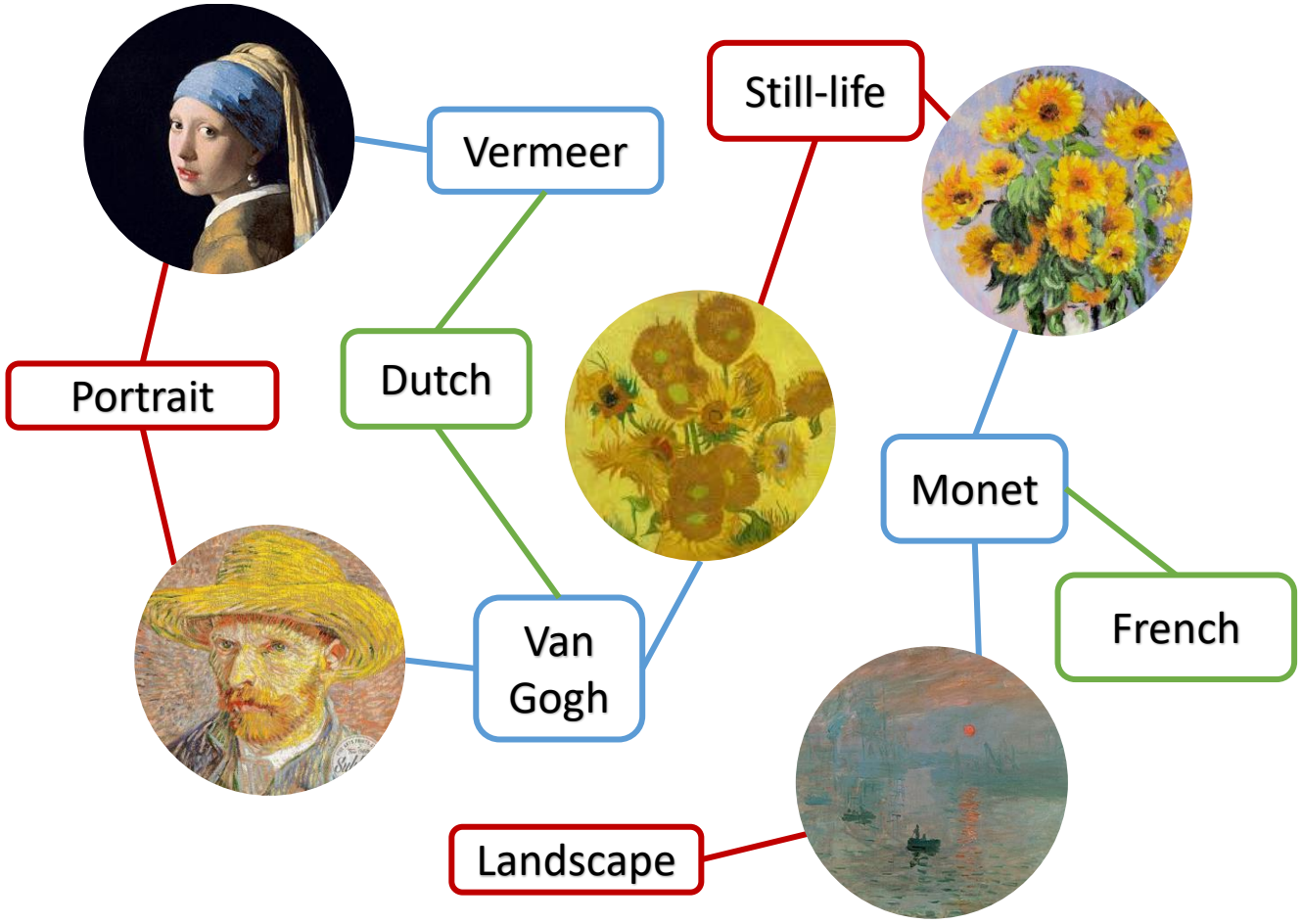
Context is obtained from metadata in a knowledge graph.

1. Knowledge Graph Construction
2. Model Training
3. Context-Aware Embeddings

Knowledge Graph Model

We use the training data from the SemArt Dataset
(Garcia and Vogiatzis, 2018)

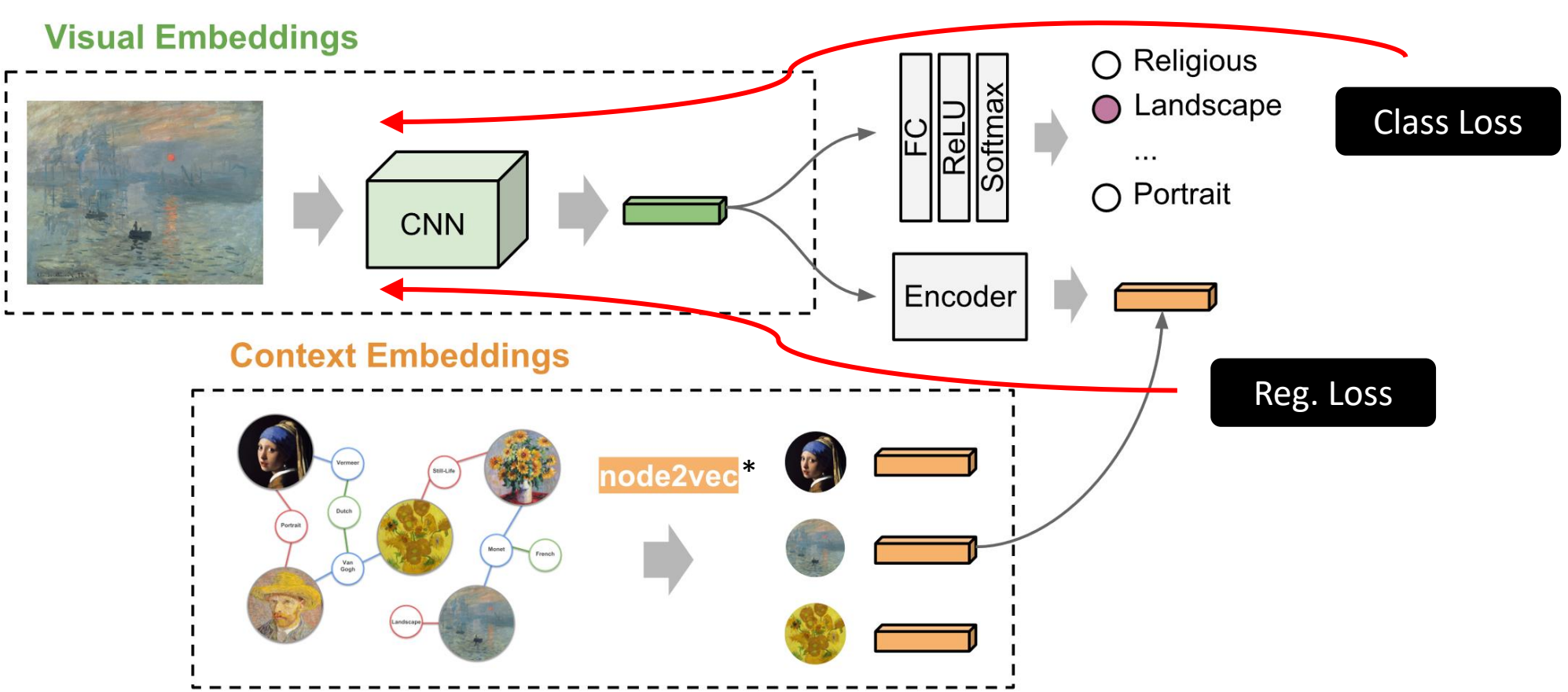
- ✓ 19,244 paintings
- ✓ 13,904 attributes
- ✓ 125,506 connecting edges



Knowledge Graph Model

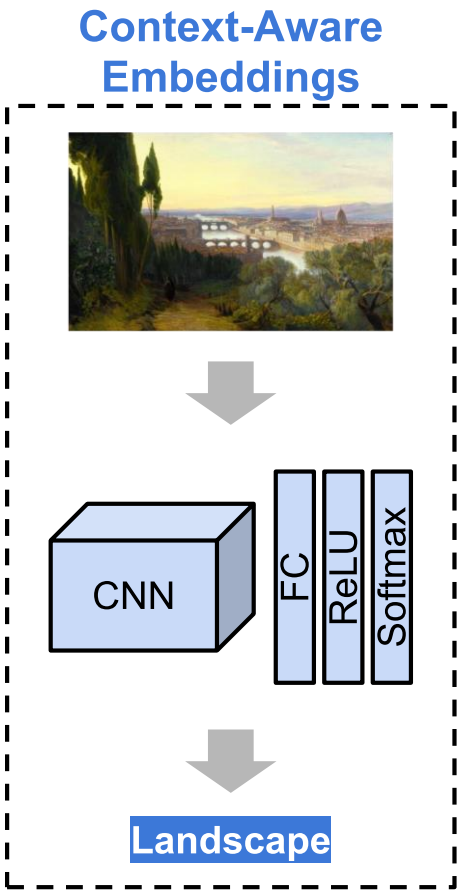
1 2 3

Model Training



* Grover & Leskovec, 2016

Knowledge Graph Model



At test time, the fine-tuned CNN generates the context-aware embeddings for unseen paintings.

Evaluation

Impression, Sunrise (1872) – Claude Monet

Art Classification

Landscape | Claude Monet | 19th century

Multimodal Retrieval

In France, public and critics both had a great deal of fun at the expense of the independent exhibitions organized in Paris. It was a journalist, Alfred Leroy, who coined the nickname "Impressionist," having used the word in his famous satirical article in Charivari on April 25, 1874. The trigger had been a work that Monet had painted in Le Havre two years earlier and that was listed in the catalog as Impression, Sunrise (Impression, soleil levant). As early as 1877, the initially pejorative term was adopted by the artists themselves and used as a rallying cry.

Evaluation: Classification

- SemArt dataset

- 4 classification tasks

Type | School | Timeframe | Author

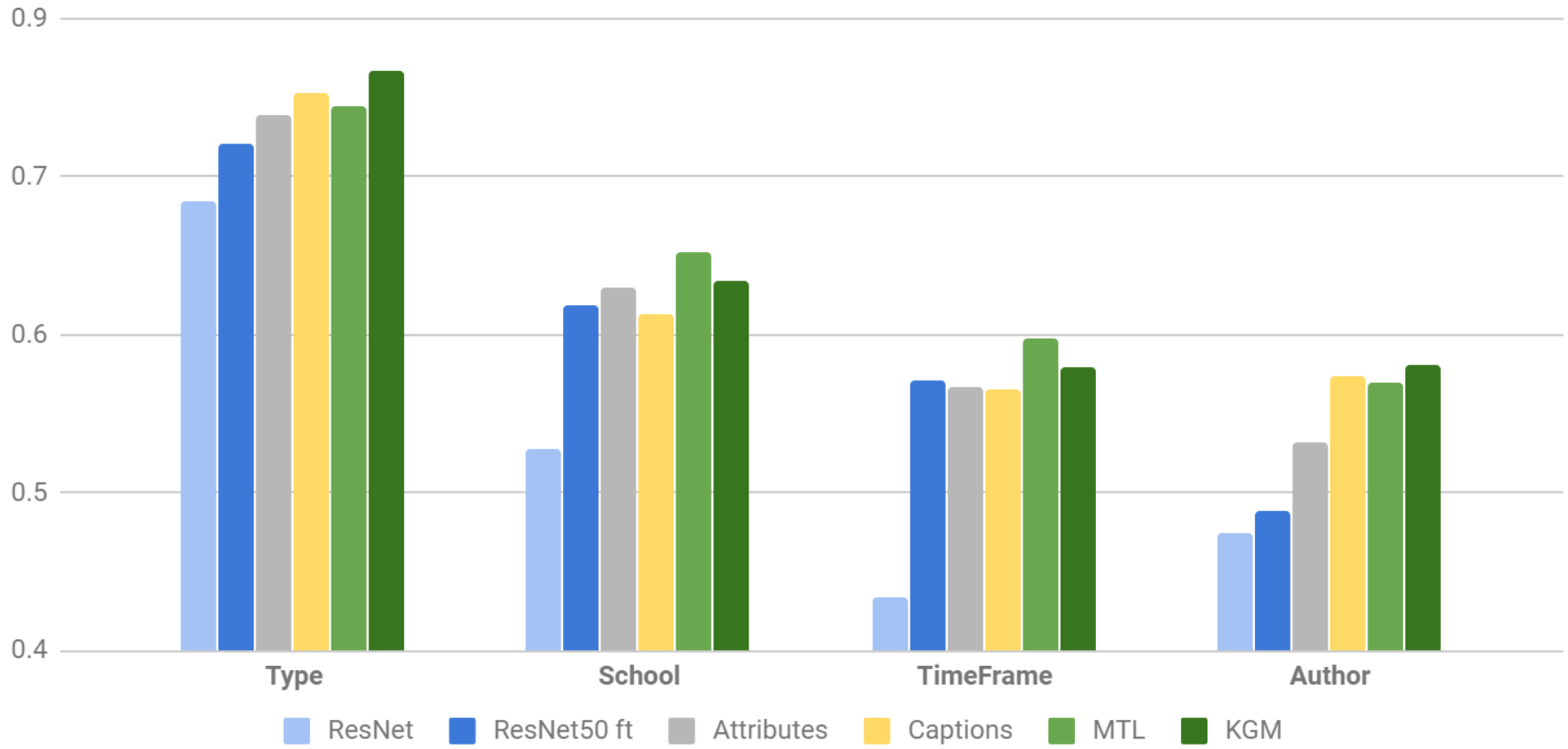
- Context-aware methods

MTL | KGM

- Non context-aware methods

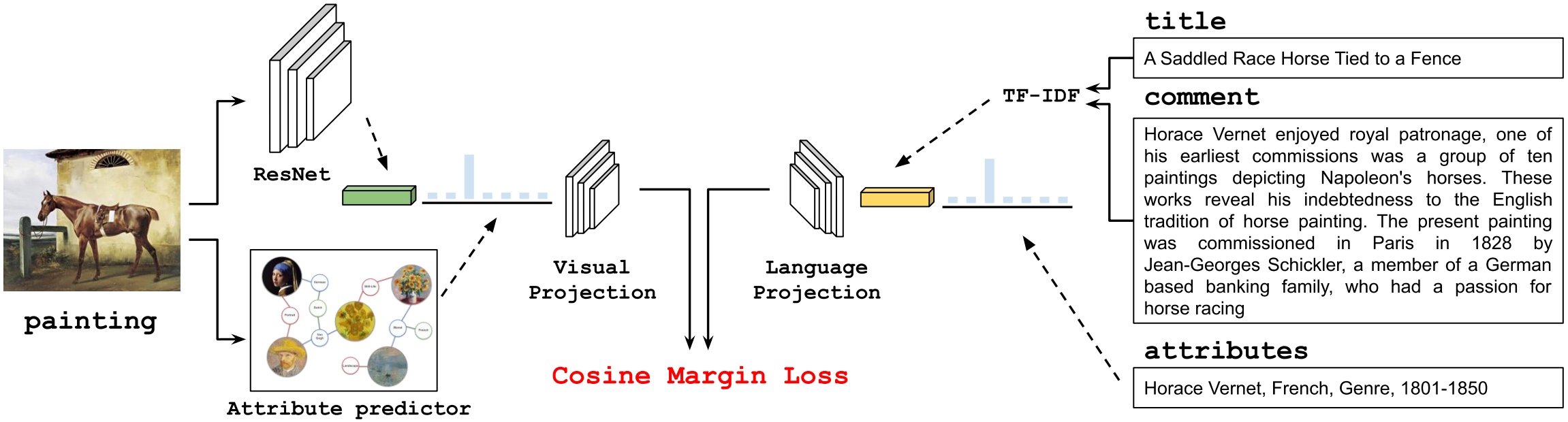
ResNet | ResNet ft | Attributes | Captions

Evaluation: Classification



Evaluation: Classification

Evaluation: Retrieval



Evaluation: Retrieval

- SemArt dataset

- 2 tasks

Text → Image

Image → Text

- Attribute predictor

No Attributes

ResNet

MTL

KGM

Evaluation: Retrieval

Text → Image

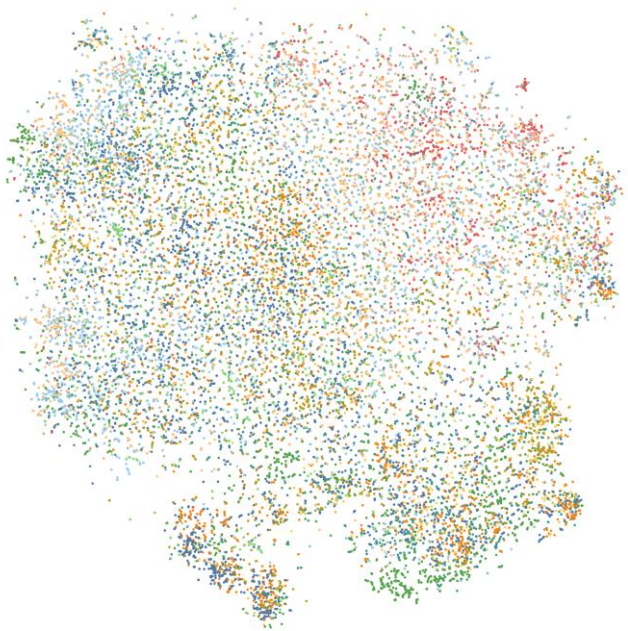
TYPE	R@1	R@5	R@10	MedR
No attributes	0.164	0.332	0.454	14
ResNet	**0.178**	**0.383**	**0.525**	**9**
MTL	0.145	0.358	0.474	12
KGM	0.152	0.367	0.506	10

SCHOOL	R@1	R@5	R@10	MedR
No attributes	0.164	0.332	0.454	14
ResNet	0.192	0.386	0.507	10
MTL	**0.196**	**0.428**	**0.536**	**8**
KGM	0.162	0.371	0.483	12

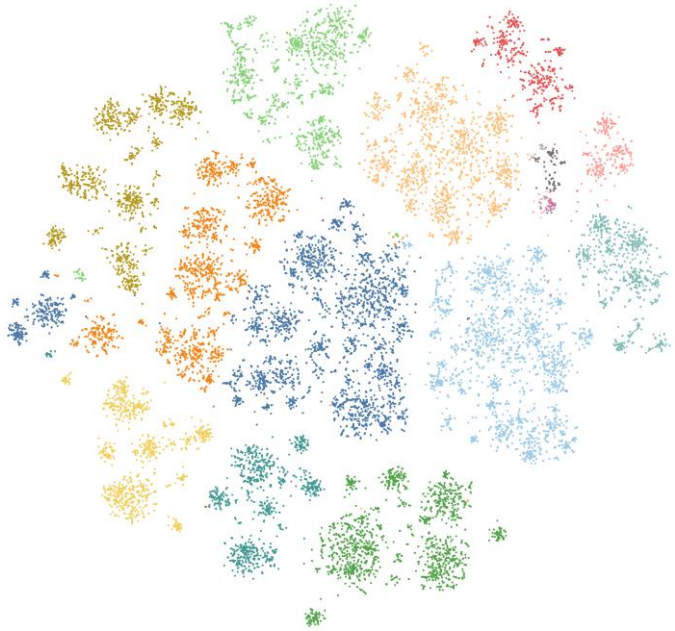
TIMEFRAME	R@1	R@5	R@10	MedR
No attributes	0.164	0.332	0.454	14
ResNet	0.127	0.332	0.434	18
MTL	0.171	0.394	**0.525**	**9**
KGM	**0.175**	**0.399**	0.506	10

AUTHOR	R@1	R@5	R@10	MedR
No attributes	0.164	0.332	0.454	14
ResNet	0.236	0.451	0.572	7
MTL	0.232	0.452	0.567	7
KGM	**0.247**	**0.477**	**0.581**	**6**

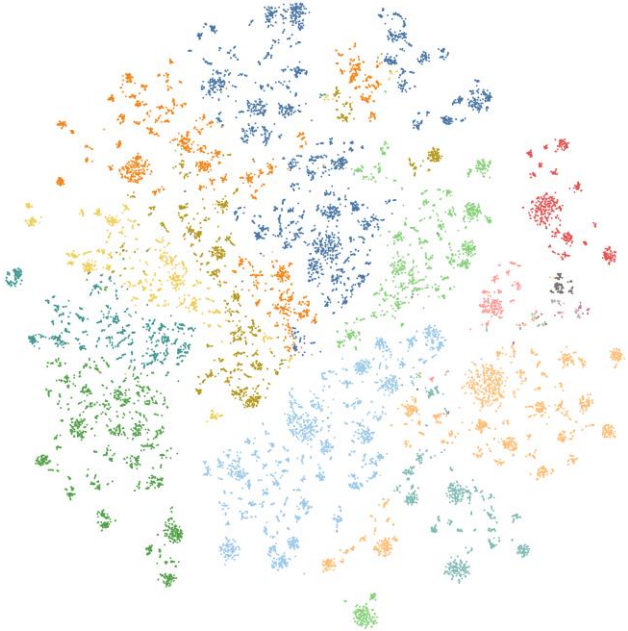
Embeddings Projections



ResNet152



node2vec



MTL

Conclusions

- We have presented two methods for capturing relationships between artistic attributes in paintings.
- Our models improved both on classification and retrieval tasks with respect to standard visual features.
- Future work will study the combination of both techniques.

Thank you!

https://github.com/noagarcia/context-art-classification

https://github.com/noagarcia/context-art-retrieval

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